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**REMARKS****Status of the Claims**

Claims 1, 7-9, 13-16, 18, 20-28, 30-37, 78-90, and 102-108 are pending in the instant application, of which claims 1, 8, 9, 13, 14, 15, 16, 18, 20, 21, 22, 78-84, 86-90, 102, 104, and 106 are being amended. Claims 4-6, 11, 12, 29, 38-77, and 91-101 are being canceled without prejudice or disclaimer as drawn to a non-elected invention, and claims 2, 3, 10, 17, and 19 are also being canceled without prejudice or disclaimer. Claims 107 and 108 are being added. The claim amendments and added claims are fully supported by the original claims and the specification, and entry of the claim amendments and added claims is respectfully requested. For example, claims 107 and 108 are supported at page 29, line 19 to page 40, line 5, of the Specification.

Reconsideration of the present application in view of the amendments and remarks herein is respectfully requested.

**Restriction Requirement**

Applicant affirms the provisional election without traverse to prosecute claims 1-3, 7-10, 13-28, 30-37, 78-90, and 102-106 made during a telephone conversation between the Examiner and Ashok Janah on 7/6/01. Claims 4-6, 11-12, 29, 38-77, and 91-101 are being canceled as drawn to a non-elected invention.

**37 CFR 1.75(c) Objection to Claims 2, 3, 14, 16-17, 26, 79, 82, 89, and 104**

The Examiner objected to claims 2, 3, 14, 16-17, 26, 79, 82, 89, and 104 under 37 CFR 1.75(c) as being of improper dependent form for allegedly failing to further limit the subject matter of a previous claim.

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Claims 2, 3, and 17 are being canceled for reasons unrelated to this objection, and this objection to these claims is thus obviated. Claim 14 is being amended, and is not believed to obviate the objection.

Claim 16, as amended, recites, inter alia, the limitation that "the controller is adapted to detect the onset and completion of processing of both materials." (Emphasis added.) It is well settled that functional language does not, in and of itself, render a claim improper or indefinite. (*In re Swinehart*, 429 F.2d 210, 169 USPQ 226, 229 (C.C.P.A. 1971).) The language "is adapted to detect the onset and completion of processing of both materials" of claim 16 serves as a further limitation on the language of claim 15 that recites "a controller adapted to ... determine both an onset and a completion of processing of the substrate from a predetermined dynamic variance of amplitude of the signal." Thus, claim 16 does further limit the subject matter of claim 15 in compliance with 37 CFR 1.75(c).

Furthermore, the language "is adapted to" is being inserted in claim 16 merely to clarify the wording of the claim to expedite prosecution, and is not the introduction of a further limitation into claim 16 because the limitation that the controller "detects the onset and completion of processing of both materials" was in the original claim as filed.

Analogously, claims 26, 79, 82, 89, and 104 are being amended only for the purpose of clarification, and not to further limit these claims. Claims 26, 79, 82, 89, and 104 properly serve as further limitations on claims 25, 78, 78, 88, and 103, respectively, in compliance with 37 CFR 1.75(c).

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**Section 112, Second Paragraph, Rejection of Claims 1-3, 7-10, 14, 20, 78-90, and 102-106**

The Examiner objected to or rejected claims 1-3, 7-10, 14, 20, 78-90, and 102-106 under 35 U.S.C. 112, second paragraph, as being indefinite for allegedly failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 2 and 3 are being canceled for reasons unrelated to this objection, and this objection to these claims is thus obviated. Claim 14 is being amended, and is not believed to obviate the objection.

In claim 1, line 4, is being amended to recite "the substrate" to clearly indicate its antecedent basis on the "substrate" recited in line 2 of the same claim.

In claim 8, line 7, "the chamber" is being amended to "the process zone" to have proper antecedent basis on the "process zone" of line 3 of the same claim.

In claim 10, line 2, "a change" is being amended to "the change" to clearly indicate its antecedent basis on the "change" of claim 9, line 2.

In claim 20, the definite article "the" is being deleted from the term "the reflectivity", as requested by the Examiner, to clearly indicate that the "reflectivity" term does not have antecedent basis.

In claim 81, "the instruction signal" is being amended to "an instruction signal" to clearly indicate that the "instruction signal" term does not have antecedent basis.

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Claims 86 and 106

Claims 86 and 106 are being amended to recite that "the instruction signal" is provided "to adjust process conditions at the beginning of processing of the substrate" (Emphasis added.) such that claims 86 and 106 are further limited in scope, from claims 85 and 105, respectively, such that the possibilities are excluded that the instruction signal is provided "to remove the substrate from the chamber" or "end processing."

Claims 78, 83, and 88

The Examiner alleges that the relationship between the recitations of "the substrate" and "a batch of substrates" is unclear in claims 78, 83, and 88 because it is unclear whether "the batch represents a series of substrates to be processed one at a time" or the batch represents "multiple substrates processed together."

However, the issue of the timewise order of processing of the substrates in the batch (whether or not the batch of substrates is processed in series or simultaneously) is irrelevant to the issue of definiteness of the claim since the claim is not attempting to define the scope of processing "the batch of substrates", but rather "the substrate." The term "a batch of substrates" refers to a plurality of substrates that is used as a reference, such as for quality control purposes, as described at page 13, line 22 to page 14, line 6 of the Specification. Thus, claims 78, 83, and 88 are allowable under Section 112, Second Paragraph.

Claim 102

The Examiner objected to the use of the term "factory automation host computer" in the claim because the Examiner alleges that "it is unclear what, if anything, 'factory automation host' provides to modify 'computer'."

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The "language of the claims, read in light of the specification" is to be considered when determining whether the claims are definite. (*Allen Archery Inc. v. Browning Mfg. Co.*, 819 F.2d 1087, 2 USPQ 2d 1490, 1494 (Fed. Cir. 1987).) "If the claims, read in the light of the specification, reasonably apprise those skilled in the art both of the utilization and scope of the invention, and if the language is as precise as the subject matter permits, the courts can demand no more." (Emphasis added. *North Am. Vaccine, Inc. v. American Cyanamid Co.*, 7 F.3d 1571, 28 USPQ 2d 1333, 1339 (Fed. Cir. 1993).)

→ The "factory automation host computer" recited in claim 102 is well-described at page 30, lines 7 to 26, of the Specification, and clearly marked as reference number "300" in the drawings. Thus, the term "factory automation host computer" does not render claim 102 indefinite, and claim 102 is allowable under Section 112, Second Paragraph. Furthermore, the term "factory automation host computer" is well-known to one of ordinary skill in the art as a host computer that may be used to operate, or receive from or send data to, other local computers connected with individual process chambers. Thus, claims 1-3, 7-10, 14, 20, 78-90, and 102-106 are allowable under Section 112, Second Paragraph, for the reasons given above.

**Section 102(b)/103(a) Rejection of Claims 8-9, 18-20, and 83-87 over the Enclosed Directions of Jamestowne Silver Polish**

The Examiner rejected claims 8-9, 18-20, and 83-87 under 35 U.S.C. § 102(b), or alternatively under 103(a), as being unpatentable over the enclosed directions on a container of Jamestowne Silver Polish (hereinafter referred to as "JSP"). This rejection is respectfully traversed.

**Claim 8**

Claim 8 is not anticipated by JSP because JSP does not teach "a method

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of processing a substrate in a process zone" comprising, inter alia, "evaluating the detected radiation to determine a property of the substrate in the process zone from a dynamic variance of amplitude of the signal." Instead, JSP teaches "Moisten a soft cloth with JAMESTOWNE'S FINE SILVER POLISH FORMULA with ANTI-TARNISH. Apply liberally until all tarnish is removed." However, applying a polish formula until all tarnish is removed is not the same as determining a property of a material on a substrate "from a dynamic variance of amplitude" of a signal. Thus, claim 8 and the claims dependent therefrom, including claim 9, are allowable over JSP under Section 102(b).

#### Claim 18

JSP fails to teach "a method of processing a substrate" comprising, inter alia, "determining a completion of processing of the overlying material from a predetermined dynamic variance of amplitude of the signal." Applying a polish formula until all tarnish is removed is not the same as determining a completion of processing of an overlying material "from a predetermined dynamic variance of amplitude of the signal." Thus, claim 18 and the claims dependent therefrom, including claims 19 and 20, are allowable over JSP under Section 102(b).

#### Claim 83

JSP does not teach "a method of processing a substrate" comprising, inter alia, "evaluating a dynamic variance of amplitude of the signal relative to a calculated or stored range of dynamic variances of amplitude of the signal for a batch of substrates to determine a property of the overlying or underlying material of the substrate." Applying a polish formula until all tarnish is removed is not the same as evaluating a dynamic variance of amplitude of a signal relative to a calculated or stored range of dynamic variances to determine a property of a material. Thus, claim 83 and the claims dependent therefrom, including claims 84-87, are allowable over JSP under Section 102(b).

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**Section 102(b) Rejection of Claims 1-3, 7-10, 13-17, 22-28, 30-31, and 34-37 over U.S. Patent 3,612,692 to Kruppa et al.**

The Examiner rejected claims 1-3, 7-10, 13-17, 22-28, 30-31, and 34-37 under 35 U.S.C. § 102(b) as being anticipated by Kruppa et al. This rejection is respectfully traversed.

**Claim 1**

Kruppa et al. fails to teach "a substrate processing apparatus" comprising, inter alia, "a controller adapted to receive the signal and determine a property of the substrate in the chamber from a dynamic variance of amplitude of the signal." Instead, Kruppa et al. teaches counting "successive minima (or maxima) in the interference pattern of light reflected from the wafer" and stopping "at a predetermined count." (Abstract.) However, this is not the same as determining a property of the underlying or overlying material on the substrate "from a dynamic variance of amplitude of the signal."

Where → The Specification explains that the dynamic variance is the extent of "change in amplitude over a predefined time period of the amplitude trace," as for example shown in Figures 2-4. Thus, claim 1 and the claims dependent therefrom are allowable over Kruppa et al. under Section 102(b).

**Claim 8**

Kruppa et al. also fails to teach "a method of processing a substrate" comprising, inter alia, "placing the substrate in the process zone," "detecting non-polarized radiation reflected from the substrate before, during, or after processing of the substrate," and "evaluating the detected radiation to determine a property of the overlying or underlying material on the substrate in the process zone from a dynamic variance of amplitude of the signal." Counting successive minima/maxima and stopping at a predetermined count is not the same as determining a property of a substrate "from a dynamic variance of amplitude of the signal." Thus, claim 8 and the claims dependent therefrom are allowable over Kruppa et al. under Section 102(b).

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Claim 13

Kruppa et al. does not teach "a substrate processing apparatus" comprising "a chamber capable of processing a substrate," "a radiation source capable of providing non-polarized radiation that is at least partially reflected from a substrate in the chamber," "a radiation detector adapted to detect the reflected radiation and generate a signal," and "a computer having a memory capable of operating a computer-readable program embodied on a computer-readable medium, the computer readable program including program code to receive the signal and determine a property of the substrate in the chamber from a dynamic variance of amplitude of the signal." Counting successive minima/maxima and stopping at a predetermined count is not the same as determining a property of a substrate "from a dynamic variance of amplitude of the signal," which is "the extent of change in amplitude over a predefined time period of the amplitude trace." Thus, claim 13 and the claims dependent therefrom are allowable over Kruppa et al. under Section 102(b).

Claim 15

Kruppa et al. fails to teach "a substrate processing apparatus" comprising "a process chamber capable of processing a substrate," "a radiation source capable of providing radiation that is at least partially reflected from the substrate during processing," "a radiation detector adapted to detect the reflected radiation and generate a signal," and "a controller adapted to receive the signal and determine both an onset and a completion of processing of the overlying material from a predetermined dynamic variance of amplitude of the signal." Counting successive minima/maxima and stopping at a predetermined count is not the same as determining a property of a substrate "from a dynamic variance of amplitude of the signal." Thus, claim 15 and the claims dependent therefrom are allowable over Kruppa et al. under Section 102(b).

Claim 22

Claim 22 is allowable over Kruppa et al. because Kruppa et al. fails to teach "a substrate processing apparatus" comprising "a chamber capable of processing

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a substrate", "a radiation source capable of providing radiation that is at least partially reflected from the substrate during processing", "a radiation detector adapted to detect the reflected radiation and generate a signal, and "a computer having a memory capable of operating computer-readable program embodied on a computer-readable medium, the computer readable program including program code to receive the signal and detect an onset and completion of processing of the overlying material from a predetermined dynamic variance of amplitude of the signal." Thus, claim 22 and the claims dependent therefrom are allowable over Kruppa et al. under Section 102(b).

#### Claim 23

Claim 23 is allowable over Kruppa et al. because Kruppa et al. does not teach "a substrate processing apparatus" comprising "a process chamber capable of processing a substrate in a plasma," "one or more radiation detectors to detect a radiation emission from the plasma and generate a first signal, and to detect a radiation reflected from the substrate and generate a second signal," and "a controller adapted to receive the first and second signals." Instead, Kruppa et al. teaches counting "successive minima (or maxima) in the interference pattern of light reflected from the wafer," which is not the same as "one or more radiation detectors to detect a radiation emission from the plasma and generate a first signal, and to detect a radiation reflected from the substrate and generate a second signal." In fact, Kruppa et al. teaches that, "preferably for measurement purposes," light coming into the photodetector should be polarized "for filtering out background light". Thus, claim 23 and the claims dependent therefrom are allowable over Kruppa et al. under Section 102(b).

#### Claim 31

Kruppa et al. fails to teach "a method of processing a substrate in a process zone" comprising, inter alia, "detecting a radiation emission from the plasma and generating a first signal", "detecting a radiation reflected from the substrate and generating a second signal", and "valuating the first and second signals to determine the occurrence of an event in the process zone or a property of a material on the

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substrate." Instead, Kruppa et al. teaches a light source (1) that generates a light beam (2), which is reflected from a wafer (5) and received by a photodetector (13). This is not the same as the method of claim 31, which recites "detecting a radiation emission from the plasma" (Emphasis added.) as well as "a radiation reflected from the substrate", and evaluating first and second signals corresponding to both radiations. Evaluating both of the radiations allows reliable and repeatable predictive endpoint algorithms. Thus, claim 31 and the claims dependent therefrom are allowable over Kruppa et al. under Section 102(b).

#### Claim 36

Claim 36 is not anticipated by Kruppa et al. because Kruppa et al. does not teach "a substrate processing apparatus" comprising, inter alia, "one or more radiation detectors to detect radiation emitted from the plasma and generate a first signal, and to detect radiation reflected from the substrate and generate a second signal" and "a computer having a memory capable of operating a computer-readable program embodied on a computer-readable medium, the computer readable program including program code to receive the first and second signals and determine an event in the chamber or a property of a material on the substrate." Thus, claim 36 and the claims dependent therefrom are allowable over Kruppa et al. under Section 102(b).

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**Section 103(a) Rejection of Claims 18-21, 32-33, 78-90, and 102-106 over Kruppa et al.**

The Examiner rejected claims 18-21, 32-33, 78-90, and 102-106 under 35 U.S.C. § 103(a) as being unpatentable over Kruppa et al. This rejection is respectfully traversed.

**Claim 18**

Kruppa et al. fails to teach a method of processing a substrate comprising, inter alia, "determining an onset of processing of the overlying material" and "determining a completion of processing of the overlying material from a predetermined dynamic variance of amplitude of the signal." Counting successive minima/maxima and stopping at a predetermined count is not the same as determining a completion of processing of an overlying material "from a predetermined dynamic variance of amplitude of the signal." There is also no motivation or suggestion in Kruppa et al. to use a "dynamic variance of amplitude of the signal." Thus, claim 18 and the claims dependent therefrom are allowable over Kruppa et al.

**Claim 31**

Kruppa et al. does not teach what is recited in claim 31 for the reasons given above. There also would not have been motivation to one of ordinary skill in the art to derive the method of claim 31 because Kruppa et al. teaches against "detecting a radiation emission from the plasma and generating a first signal", "detecting a radiation reflected from the substrate and generating a second signal", and "evaluating the first and second signals to determine the occurrence of an event in the process zone or a property of a material on the substrate." Kruppa et al. teaches against the method of claim 31 by teaching that, "preferably for measurement purposes," light coming into the photodetector should be polarized "for filtering out background light". In contrast, the specification of the instant application teaches the detection of both "radiation emission from the plasma" and "radiation reflected from the substrate" allows reliable and

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repeatable predictive endpoint algorithms. Thus, claim 31 and the claims dependent therefrom are allowable over Kruppa et al.

#### Claim 78

Kruppa et al. fails to teach a substrate processing apparatus comprising, inter alia, "a controller adapted to receive the signal and evaluate a dynamic variance of amplitude of the signal in relation to a calculated or stored range of dynamic variances of amplitude of the signal for a batch of substrates to determine a property of the overlying or underlying material of the substrate." Counting successive minima/maxima and stopping at a predetermined count is not the same as a controller adapted to "evaluate a dynamic variance ... in relation to a calculated or stored range of dynamic variances ... for a batch of substrates." Thus, claim 78 and the claims dependent therefrom are allowable over Kruppa et al.

#### Claim 83

Kruppa et al. does not teach a method of processing a substrate comprising, inter alia, "evaluating a dynamic variance of amplitude of the signal relative to a calculated or stored range of dynamic variances of amplitude of the signal for a batch of substrates to determine a property of the overlying or underlying material of the substrate." Counting successive minima/maxima and stopping at a predetermined count is different from "[evaluating] a dynamic variance ... relative to a calculated or stored range of dynamic variances ... for a batch of substrates." Thus, claim 83 and the claims dependent therefrom are allowable over Kruppa et al.

#### Claim 88

Kruppa et al. fails to teach a substrate processing apparatus comprising, inter alia, "a computer having a memory capable of operating a computer-readable program embodied on a computer-readable medium, the computer readable program including program code to receive the signal and evaluate a dynamic variance of amplitude of the signal in relation to a range of dynamic variances of amplitude of the

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signal for a batch of substrates to determine a property of the overlying or underlying material of the substrate." Counting successive minima/maxima and stopping at a predetermined count is not the same as a computer having a computer-readable program to "evaluate a dynamic variance ... in relation to a calculated or stored range of dynamic variances ... for a batch of substrates." Thus, claim 88 and the claims dependent therefrom are allowable over Kruppa et al.

#### Claim 102

Kruppa et al. does not teach a substrate processing apparatus comprising, Inter alia, "a radiation detector adapted to detect the reflected radiation and generate a signal having a dynamic variance of amplitude", "a controller adapted to receive the signal and generate a set of data from the dynamic variance of amplitude relating to a property of the overlying or underlying material of the substrate", and "a factory automation host computer to receive and evaluate the data, and control the processing of the substrate in relation to the data." Counting successive minima/maxima and stopping at a predetermined count is different from a controller adapted to "generate a set of data from the dynamic variance of amplitude relating to a property of the substrate." Thus, claim 102 and the claims dependent therefrom are allowable over Kruppa et al.

#### Section 102(b) Rejection of Claims 1-3, 7-10, 13-28, 30, 78-80, 82-85, and 87-90 over U.S. Patent 4,198,261 to Busta et al.

The Examiner rejected claims 1-3, 7-10, 13-28, 30, 78-80, 82-85, and 87-90 under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent 4,198,261 to Busta et al. This rejection is respectfully traversed.

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Claim 1

Busta et al. fails to teach "a substrate processing apparatus" comprising "a process chamber capable of processing a substrate, the substrate having an overlying material and an underlying dielectric", "a radiation source capable of providing non-polarized radiation that is at least partially reflected from the substrate in the chamber", "a radiation detector adapted to detect the reflected radiation and generate a signal", and "a controller adapted to receive the signal and determine a property of the overlying or underlying material on the substrate in the chamber from a dynamic variance of amplitude of the signal." Instead, Busta et al. teaches detecting the endpoint of etching a layer (41) by detecting a change from a "maximum and minimum wave form" to a "substantially fixed, nonrefracted, reflected light output." (Col. 3, lines 53-60.) Detecting this "substantially fixed ... light output" is not the same as "determining a property of the substrate ... from a dynamic variance of amplitude of the signal." (Emphasis added.) The dynamic variance is the extent of "change in amplitude over a predefined time period of the amplitude trace," (Emphasis added.) as described in the Specification. Thus, claim 1 and the claims dependent therefrom are allowable over Busta et al. under Section 102(b).

Claim 8

Busta et al. does not teach a method of processing a substrate comprising, inter alia, "evaluating the detected radiation to determine a property of the substrate in the process zone from a dynamic variance of amplitude of the signal." Detecting a change from a "maximum and minimum wave form" to a "substantially fixed, nonrefracted, reflected light output" is not the same as "determining a property of the overlying or underlying material on the substrate ... from a dynamic variance of amplitude of the signal." Thus, claim 8 and the claims dependent therefrom are allowable over Busta et al. under Section 102(b).

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Claim 13

Busta et al. does not teach "a substrate processing apparatus" comprising, inter alia, "a computer having a memory capable of operating a computer-readable program embodied on a computer-readable medium, the computer readable program including program code to receive the signal and determine a property of the overlying or underlying material on the substrate in the chamber from a dynamic variance of amplitude of the signal." Detecting a change from a "maximum and minimum wave form" to a "substantially fixed, nonrefracted, reflected light output" is different from "determining a property of the overlying or underlying material on the substrate ... from a dynamic variance of amplitude of the signal." Thus, claim 13 and the claims dependent therefrom are allowable over Busta et al. under Section 102(b).

Claim 15

Claim 15 is allowable over Busta et al. because Busta et al. does not teach "a substrate processing apparatus comprising", inter alia, "a controller adapted to receive the signal and determine both an onset and a completion of processing of the overlying material from a predetermined dynamic variance of amplitude of the signal." Busta et al. teaches detecting a change from a "maximum and minimum wave form" to a "substantially fixed, nonrefracted, reflected light output," whereas claim 15 recites a controller adapted to "determining both an onset and a completion of processing of the overlying material ... from a predetermined dynamic variance of amplitude of the signal." Thus, claim 15 and the claims dependent therefrom are allowable over Busta et al. under Section 102(b).

Claim 18

Claim 18 is allowable over Busta et al. because Busta et al. fails to teach "a method of processing a substrate in a process zone" comprising, inter alia, "determining a completion of processing of the overlying material from a predetermined dynamic variance of amplitude of the signal." Detecting a change from a "maximum and minimum wave form" to a "substantially fixed, nonrefracted, reflected light output" is

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different from "determining a completion of processing of the overlying material ... from a dynamic variance of amplitude of the signal." Thus, claim 18 and the claims dependent therefrom are allowable over Busta et al. under Section 102(b).

#### Claim 22

Claim 22 is allowable over Busta et al. because Busta et al. does not teach "a substrate processing apparatus comprising", inter alia, "a computer having a memory capable of operating computer-readable program embodied on a computer-readable medium, the computer readable program including program code to receive the signal and detect an onset and completion of processing of the overlying material from a predetermined dynamic variance of amplitude of the signal." Busta et al. teaches detecting a change from a "maximum and minimum wave form" to a "substantially fixed, nonrefracted, reflected light output," whereas claim 22 recites a computer having computer-readable program code to "detect an onset and completion of processing of the overlying material from a predetermined dynamic variance of amplitude of the signal." Thus, claim 22 and the claims dependent therefrom are allowable over Busta et al. under Section 102(b).

#### Claim 23

Claim 23 is allowable over Busta et al. under Section 102(b) because Busta et al. does not teach "one or more radiation detectors to detect a radiation emission from the plasma and generate a first signal, and to detect a radiation reflected from the substrate and generate a second signal." (Emphasis added.) Instead, Busta et al. detects reflected and refracted light (33) from a layer (23) being etched, and generates a single output. (Col. 3, lines 3-66.) Busta et al. teaches against claim 23 because Busta et al. considers detecting a color intensity change of the plasma to be "highly subjective and rather gross" (Col. 1, line 34.), and Figure 1 shows a "substantially uniform frequency light" (31) (Col. 3, line 10.) being reflected and refracted into a light (33) that is detected. Thus, claim 23 and the claims dependent therefrom are allowable over Busta et al. under 102(b).

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Claim 78

Busta et al. also fails to anticipate claim 78 because Busta et al. does not teach "a substrate processing apparatus comprising", inter alia, "a controller adapted to receive the signal and evaluate a dynamic variance of amplitude of the signal in relation to a calculated or stored range of dynamic variances of amplitude of the signal for a batch of substrates to determine a property of the overlying or underlying material of the substrate." Detecting a change from a "maximum and minimum wave form" to a "substantially fixed, nonrefracted, reflected light output," as taught by Busta et al., is different from a controller adapted to "evaluate a dynamic variance of amplitude of the signal in relation to a calculated or stored range of dynamic variances ... for a batch of substrates ..." Thus, claim 78 and the claims dependent therefrom are allowable over Busta et al. under Section 102(b).

Claim 83

Busta et al. does not anticipate claim 83 because Busta et al. fails to teach "a method of processing a substrate in a process zone" comprising, inter alia, "evaluating a dynamic variance of amplitude of the signal relative to a calculated or stored range of dynamic variances of amplitude of the signal for a batch of substrates to determine a property of the overlying or underlying material of the substrate." Detecting a change from a "maximum and minimum wave form" to a "substantially fixed, nonrefracted, reflected light output," as taught by Busta et al., is not the same as "evaluating a dynamic variance of amplitude of the signal relative to a calculated or stored range of dynamic variances ... for a batch of substrates ..." Thus, claim 83 and the claims dependent therefrom are allowable over Busta et al. under Section 102(b).

Claim 88

Busta et al. also does not anticipate claim 88 because Busta et al. does not teach a substrate processing apparatus comprising, inter alia, "a computer having a memory capable of operating a computer-readable program embodied on a computer-readable medium, the computer readable program including program code to receive

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the signal and evaluate a dynamic variance of amplitude of the signal in relation to a range of dynamic variances of amplitude of the signal for a batch of substrates to determine a property of the overlying or underlying material of the substrate." Detecting a change from a "maximum and minimum wave form" to a "substantially fixed, nonrefracted, reflected light output," as taught by Busta et al., is different from a computer having a computer-readable program to "evaluate a dynamic variance of amplitude of the signal in relation to a calculated or stored range of dynamic variances ... for a batch of substrates ..." Thus, claim 88 and the claims dependent therefrom are allowable over Busta et al. under Section 102(b).

**Section 103(a) Rejection of Claims 81, 86, and 102-106 over Busta et al.**

The Examiner rejected claims 81, 86, and 102-106 under 35 U.S.C. § 103(a) as being unpatentable over Busta et al. This rejection is respectfully traversed.

**Claim 78**

Busta et al. does not teach what is recited in claim 78 for the reasons given above. Furthermore, there would not have been motivation to one of ordinary skill to derive claim 78 from the teachings of Busta et al. Busta et al. teaches against a controller adapted to "evaluate a dynamic variance of amplitude of the signal in relation to a calculated or stored range of dynamic variances ... for a batch of substrates ..." by teaching detecting a change from a "maximum and minimum wave form" to a "substantially fixed, nonrefracted, reflected light output." Thus, claim 78 and the claims dependent therefrom, including claim 81, are allowable over Busta et al.

**Claim 83**

Busta et al. fails to teach what is recited in claim 83 for the reasons given above. Furthermore, there would not have been motivation to one of ordinary skill to derive claim 83 from the teachings of Busta et al. Detecting a change from a

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"maximum and minimum wave form" to a "substantially fixed, nonrefracted, reflected light output," as taught by Busta et al., is not the same as "evaluating a dynamic variance of amplitude of the signal relative to a calculated or stored range of dynamic variances ... for a batch of substrates ..." Thus, claim 83 and the claims dependent therefrom, including claim 86, are allowable over Busta et al.

**Claim 102**

"a substrate processing apparatus comprising", inter alia, "a radiation detector adapted to detect the reflected radiation and generate a signal having a dynamic variance of amplitude", "a controller adapted to receive the signal and generate a set of data from the dynamic variance of amplitude relating to a property of the overlying or underlying material of the substrate", and "a factory automation host computer to receive and evaluate the data, and control the processing of the substrate in relation to the data." Thus, claim 102 and the claims dependent therefrom, including claim 106, are allowable over Busta et al.

**Section 102(b) Rejection of Claims 1-2, 7-9, 13-20, 22, and 78-90 over U.S. Patent 4,317,698 to Christol et al.**

The Examiner rejected claims 1-2, 7-9, 13-20, 22, and 78-90 under 35 U.S.C. § 102(b) as being anticipated by Christol et al. This rejection is respectfully traversed.

**Claim 1**

Christol et al. fails to teach "a substrate processing apparatus" comprising, inter alia, "a controller adapted to receive the signal and determine a property of the overlying or underlying material on the substrate in the chamber from a dynamic variance of amplitude of the signal," as recited in claim 1. Instead, Christol et al. teaches "subtracting the inflection level from the threshold level and taking a

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predetermined fraction of the resultant level to define a second threshold level further in the etch cycle which anticipates the end of the etch cycle." Detecting the occurrence of the threshold level, as in Christol et al., is not the same as a controller adapted to determine "a property of the overlying or underlying material on the substrate in the chamber from a dynamic variance of amplitude of the signal." Thus, claim 1 and the claims dependent therefrom are allowable over Christol et al. under Section 102(b).

#### Claim 8

Claim 8 recites a method of processing a substrate comprising, inter alia, "evaluating the detected radiation to determine a property of the overlying or underlying material on the substrate in the process zone from a dynamic variance of amplitude of the signal." Detecting the occurrence of a threshold level is different from a controller adapted to determine "a property of the overlying or underlying material on the substrate in the process zone from a dynamic variance of amplitude of the signal." Thus, claim 8 and the claims dependent therefrom are allowable over Christol et al. under Section 102(b).

#### Claim 13

Claim 13 recites "a substrate processing apparatus" comprising, inter alia, "a computer having a memory capable of operating a computer-readable program embodied on a computer-readable medium, the computer readable program including program code to receive the signal and determine a property of the underlying or overlying material on the substrate in the chamber from a dynamic variance of amplitude of the signal." Detecting the occurrence of a threshold level is different from a computer having a computer-readable program to determine "a property of the overlying or underlying material on substrate in the chamber from a dynamic variance of amplitude of the signal." Thus, claim 13 and the claims dependent therefrom are allowable over Christol et al. under Section 102(b).

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Claim 18

Claim 18 is not anticipated by Christol et al. because detecting the occurrence of a threshold level, as in Christol et al., is not the same as determining a completion of processing of an overlying material "from a predetermined dynamic variance of amplitude of the signal", as in claim 18. Thus, claim 18 and the claims dependent therefrom are allowable over Christol et al. under Section 102(b).

Claim 22

Claim 22 recites "a substrate processing apparatus" comprising "a chamber capable of processing a substrate", "a radiation source capable of providing radiation that is at least partially reflected from the substrate during processing", "a radiation detector adapted to detect the reflected radiation and generate a signal, and "a computer having a memory capable of operating computer-readable program embodied on a computer-readable medium, the computer readable program including program code to receive the signal and detect an onset and completion of processing of the overlying material from a predetermined dynamic variance of amplitude of the signal." Detecting the occurrence of a threshold level is different from a computer having a computer-readable program to "detect an onset and completion of processing of the overlying material from a predetermined dynamic variance of amplitude of the signal." Thus, claim 22 and the claims dependent therefrom are allowable over Christol et al. under Section 102(b).

Claim 78

Claim 78 recites "a substrate processing apparatus comprising", inter alia, "a controller adapted to receive the signal and evaluate a dynamic variance of amplitude of the signal in relation to a calculated or stored range of dynamic variances of amplitude of the signal for a batch of substrates to determine a property of the overlying or underlying material of the substrate." Detecting the occurrence of a threshold level is not the same as a controller adapted to "evaluate a dynamic variance ... in relation to a calculated or stored range of dynamic variances ... for a batch of

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substrates." Thus, claim 78 and the claims dependent therefrom are allowable over Christol et al. under Section 102(b).

**Section 103(a) Rejection of Claims 102-106 over Christol et al.**

The Examiner rejected claims 102-106 under 35 U.S.C. § 103(a) as being unpatentable over Christol et al. This rejection is respectfully traversed.

Claim 102 is allowable over Christol et al. because Christol et al. fails to teach "a substrate processing apparatus comprising: a chamber capable of processing a substrate", a radiation source capable of providing radiation that is at least partially reflected from a substrate in the chamber", "a radiation detector adapted to detect the reflected radiation and generate a signal", "a controller adapted to receive the signal and generate a set of data from the dynamic variance of amplitude relating to a property of the overlying or underlying material of the substrate", and "a factory automation host computer to receive and evaluate the data, and control the processing of the substrate in relation to the data." Detecting the occurrence of a threshold level is not the same as a controller adapted to "generate a set of data from the dynamic variance of amplitude relating to a property of the overlying or underlying material of the substrate." Thus, claim 102 and the claims dependent therefrom are allowable over Christol et al.

**Section 102(b) Rejection of Claims 1-3, 7-10, 13-28, 30, and 78-90 over Brooks, Jr. et al.**

The Examiner rejected claims 1-3, 7-10, 13-28, 30, and 78-90 under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent 4,611,919 to Brooks, Jr. et al. This rejection is respectfully traversed.

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A/N: 09/545,110  
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Claim 1 recites "a substrate processing apparatus" comprising, inter alia, "a controller adapted to receive the signal and determine a property of the overlying or underlying material on the substrate in the chamber from a dynamic variance of amplitude of the signal." Instead, Brooks Jr. et al. teaches identifying a final maximum point of a signal by identifying a zero-crossing point of a first derivative or a corresponding reference point of a second derivative. (Col. 6, lines 20-68.) However, identifying a final maximum point is not the same as a controller that uses a dynamic variance of amplitude of a signal, which is the extent of "change in amplitude over a predefined time period of the amplitude trace." Thus, claim 1 and the claims dependent therefrom are allowable over Brooks, Jr. et al. under Section 102(b).

Claim 8

Claim 8 is not anticipated by Brooks, Jr. et al. because Brooks, Jr. et al. fails to teach a method of processing a substrate comprising, inter alia, "evaluating the detected radiation to determine a property of the overlying or underlying material on substrate in the process zone from a dynamic variance of amplitude of the signal." Identifying a final maximum point is not the same as evaluating a detected radiation from a dynamic variance of amplitude of a signal, which is the extent of "change in amplitude over a predefined time period of the amplitude trace." Thus, claim 8 and the claims dependent therefrom are allowable over Brooks, Jr. et al. under Section 102(b).

Claim 23

Brooks, Jr. et al. fails to anticipate claim 23 because Brooks, Jr. et al. does not teach "one or more radiation detectors to detect a radiation emission from the plasma and generate a first signal, and to detect a radiation reflected from the substrate and generate a second signal." (Emphasis added.) Instead, Brooks, Jr. et al. teaches that the laser energy is passed "through optical filter (19) which has passband centered about the frequency of laser (15)," thus filtering out the radiation emission from the plasma. Thus, claim 23 and the claims dependent therefrom are allowable over

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Brooks, Jr. et al. under Section 102(b).

Claim 78

Claim 78 is not anticipated by Brooks, Jr. et al. because Brooks, Jr. et al. fails to teach a substrate processing apparatus comprising, inter alia, "a controller adapted to receive the signal and evaluate a dynamic variance of amplitude of the signal in relation to a calculated or stored range of dynamic variances of amplitude of the signal for a batch of substrates to determine a property of the overlying or underlying material of the substrate." Identifying a final maximum point is not the same as a controller that uses a dynamic variance of amplitude of a signal. Thus, claim 78 and the claims dependent therefrom are allowable over Brooks, Jr. et al. under Section 102(b).

Section 103(a) Rejection of Claims 102-106 over Brooks, Jr. et al.

The Examiner rejected claims 102-106 under 35 U.S.C. § 103(a) as being unpatentable over Brooks, Jr. et al. This rejection is respectfully traversed.

Brooks, Jr. et al. does not teach a substrate processing apparatus comprising, inter alia, "a radiation detector adapted to detect the reflected radiation and generate a signal having a dynamic variance of amplitude", "a controller adapted to receive the signal and generate a set of data from the dynamic variance of amplitude relating to a property of the underlying or overlying material of the substrate", and "a factory automation host computer to receive and evaluate the data, and control the processing of the substrate in relation to the data." Instead, Brooks, Jr. et al. teaches identifying a final maximum point of a signal, which is not the same as a controller adapted to generate a set of data from the dynamic variance of amplitude relating to a property of the substrate, and a factory automation host computer adapted to evaluate said data. Thus, claim 102 and the claims dependent therefrom are allowable over

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Brooks, Jr. et al.

**Section 102(b) Rejection of Claims 1-3, 7-10, 15-21, 23-28, 30-35, and 78-87 over Schoenborn**

The Examiner rejected claims 1-3, 7-10, 15-21, 23-28, 30-35, and 78-87 under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent 5,362,356 to Schoenborn et al. This rejection is respectfully traversed.

**Claim 1**

Schoenborn et al. does not anticipate claim 1 because Schoenborn et al. does not teach "a substrate processing apparatus" comprising, inter alia, "a controller adapted to receive the signal and determine a property of the overlying or underlying material on the substrate in the chamber from a dynamic variance of amplitude of the signal." Instead, Schoenborn et al. teaches using a minimum of absorption of plasma emission by the substrate to call endpoint. However, locating a minimum in an intensity signal is not the same as a controller "adapted to ... determine a property of the ... substrate ... from a dynamic variance of amplitude of the signal." Thus, claim 1 and the claims dependent therefrom are allowable over Schoenborn et al. under Section 102(b).

**Claim 8**

Schoenborn et al. also does not anticipate claim 8 because Schoenborn et al. fails to teach "a method of processing a substrate" comprising, inter alia, "placing the substrate in the process zone," "detecting non-polarized radiation reflected from the substrate before, during, or after processing of the substrate," and "evaluating the detected radiation to determine a property of the overlying or underlying material on the substrate in the process zone from a dynamic variance of amplitude of the signal." Locating a minimum in an intensity signal is different from a controller "adapted to ... determine a property of the ... substrate ... from a dynamic variance of amplitude of the

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signal." Thus, claim 8 and the claims dependent therefrom are allowable over Schoenborn et al. under Section 102(b).

#### Claim 23

Claim 23 is allowable over Schoenborn et al. under Section 102(b) because Schoenborn et al. does not teach "one or more radiation detectors to detect a radiation emission from the plasma and generate a first signal, and to detect a radiation reflected from the substrate and generate a second signal." Instead, Schoenborn et al. teaches monitoring plasma emission intensity at a selected wavelength. (Abstract.) Schoenborn et al. generates only a single signal, rather than generating "a first signal" corresponding to a radiation emission from the plasma and generating "a second signal" corresponding to a radiation reflected from the substrate. Thus, claim 23 and the claims dependent therefrom are allowable over Schoenborn et al. under Section 102(b).

#### Section 103(a) Rejection of Claims 102-106 over Schoenborn

The Examiner rejected claims 102-106 under 35 U.S.C. § 103(a) as being unpatentable over Schoenborn et al. This rejection is respectfully traversed.

Claim 102 is allowable over Schoenborn et al. because Schoenborn et al. fails to teach a substrate processing apparatus comprising, inter alia, "a radiation detector adapted to detect the reflected radiation and generate a signal having a dynamic variance of amplitude", "a controller adapted to receive the signal and generate a set of data from the dynamic variance of amplitude relating to a property of the overlying or underlying material of the substrate", and "a factory automation host computer to receive and evaluate the data, and control the processing of the substrate in relation to the data." Locating a minimum in an intensity signal, as in Schoenborn et al., is not the same as a controller "adapted to generate a set of data from the dynamic

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variance of amplitude relating to a property of the overlying or underlying material of the substrate." Thus, claim 102 and the claims dependent therefrom are allowable over Schoenborn et al.

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### CONCLUSION

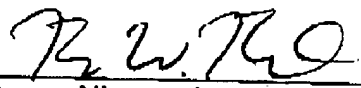
For the foregoing reasons, allowance of the instant application is respectfully requested. Should the Examiner have any questions regarding the above amendments or remarks, the Examiner is requested to telephone Applicant's representative at the number listed below.

Respectfully submitted,

JANAH & ASSOCIATES  
A PROFESSIONAL CORPORATION

Date: November 5, 2002

By:

  
Reece Nienstadt  
Reg. No. 52,072

Please direct telephone calls to:

Reece Nienstadt  
(415) 538-1555

Please continue to send all correspondence to:

Patent Counsel  
APPLIED MATERIALS, INC.  
P.O. Box 450A  
Santa Clara, California 95052

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**MARKED-UP CLAIMS FOR A/N 09/545,110**

1. (once amended) A substrate processing apparatus comprising:  
a process chamber capable of processing a substrate, the  
substrate having overlying and underlying materials;

a radiation source capable of providing non-polarized radiation that  
is at least partially reflected from [a] the substrate in the chamber;

a radiation detector adapted to detect the reflected radiation and  
generate a signal; and

a controller adapted to receive the signal and determine a property  
of [a] the overlying or underlying material on the substrate in the chamber from a  
dynamic variance of amplitude of the signal.

8. (once amended) A method of processing a substrate in a  
process zone, the method comprising the steps of:

(a) placing the substrate in the process zone, the substrate  
having overlying and underlying materials;

(b) detecting non-polarized radiation reflected from the  
substrate before, during, or after processing of the substrate; and

(c) evaluating the detected radiation to determine a property of  
[a] the overlying or underlying material on the substrate in the [chamber] process zone  
from a dynamic variance of amplitude of the signal.

9. (once amended) A method according to claim 8 comprising  
determining the thickness [property] of the underlying material on the substrate from [a  
change in amplitude] the dynamic variance of the reflected radiation.

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13. (once amended) A substrate processing apparatus comprising:

- (a) a chamber capable of processing a substrate, the substrate having overlying and underlying materials;
- (b) a radiation source capable of providing non-polarized radiation that is at least partially reflected from [a] the substrate in the chamber;
- (c) a radiation detector adapted to detect the reflected radiation and generate a signal; and
- (d) a computer having a memory capable of operating a computer-readable program embodied on a computer-readable medium, the computer readable program including program code to receive the signal and determine a property of [a] the overlying or underlying material on the substrate in the chamber from a dynamic variance of amplitude of the signal.

14. (once amended) An apparatus according to claim 13 wherein the program code is adapted to determine [determines a property of the material from a change in amplitude] (i) a thickness of the underlying material or (ii) a dopant level of the overlying material from the dynamic variance of the reflected radiation.

15. (once amended) A substrate processing apparatus comprising:

- (a) a process chamber capable of processing a substrate, the substrate having overlying and underlying materials;
- (b) a radiation source capable of providing radiation that is at least partially reflected from the substrate during processing;
- (c) a radiation detector adapted to detect the reflected radiation and generate a signal; and
- (d) a controller adapted to receive the signal and determine both an onset and a completion of processing of [a] the overlying material on the substrate from a predetermined dynamic variance of amplitude of the signal.

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16. (once amended) An apparatus according to claim 15 wherein [first and second materials] the overlying and underlying materials are processed on the substrate, and wherein the controller is adapted to detect the onset and completion of processing of both materials.

18. (once amended) A method of processing a substrate in a process zone, the method comprising the steps of:

- (a) placing the substrate in the process zone, the substrate having overlying and underlying materials;
- (b) setting process conditions in the process zone to process the substrate;
- (c) detecting radiation reflected from the substrate during processing and generating a signal;
- (d) determining an onset of processing of [a] the overlying material on the substrate; and
- (e) determining a completion of processing of the overlying material from a predetermined dynamic variance of amplitude of the signal.

20. (once amended) A method according to claim 19 wherein the change in amplitude results from changes in [the] reflectivity or thickness of the material.

21. (once amended) A method according to claim 19 wherein the change in amplitude is characterized by a constructive or destructive interference of radiation reflected from the substrate surface and radiation transmitted through a thickness of the overlying material and reflected from one or more underlying interfaces.

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22. (once amended) A substrate processing apparatus comprising:

- (a) a chamber capable of processing a substrate, the substrate having overlying and underlying materials;
- (b) a radiation source capable of providing radiation that is at least partially reflected from the substrate during processing;
- (c) a radiation detector adapted to detect the reflected radiation and generate a signal; and
- (d) a computer having a memory capable of operating computer-readable program embodied on a computer-readable medium, the computer readable program including program code to receive the signal and detect an onset and completion of processing of [a] the overlying material on the substrate from a predetermined dynamic variance of amplitude of the signal.

78. (once amended) A substrate processing apparatus comprising:

- a chamber capable of processing a substrate, the substrate having overlying and underlying materials;
- a radiation source capable of providing radiation that is at least partially reflected from a substrate in the chamber;
- a radiation detector adapted to detect the reflected radiation and generate a signal; and
- a controller adapted to receive the signal and evaluate [an amplitude change] a dynamic variance of amplitude of the signal [of the reflected radiation] in relation to a calculated or stored range of [amplitude changes] dynamic variances of amplitude of the signal for a batch of substrates to determine a property of the overlying or underlying material of the substrate.

79. (once amended) An apparatus according to claim 78 wherein the controller is adapted to [evaluates] evaluate the [amplitude change] dynamic variance to determine if the [amplitude change] dynamic variance is within the calculated or stored range.



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80. (once amended) An apparatus according to claim 78 wherein the controller is further adapted to provide an instruction signal to remove the substrate from the chamber, end processing, or adjust process conditions, in response to the evaluation of the [amplitude change] dynamic variance.

81. (once amended) An apparatus according to claim 78 wherein the controller is adapted to provide [the] an instruction signal at the beginning of processing of the substrate.

82. (once amended) An apparatus according to claim 78 wherein the controller is adapted to evaluate [amplitude change comprises] a change in [a] the dynamic variance of the amplitude.

83. (once amended) A method of processing a substrate in a process zone, the method comprising the steps of:

(a) placing the substrate in the process zone, the substrate having overlying and underlying materials;

(b) detecting radiation reflected from the substrate before, during, or after processing of the substrate and generating a signal; and

(c) evaluating [an amplitude change] a dynamic variance of amplitude of the [reflected radiation] signal relative to a calculated or stored range of [amplitude changes] dynamic variances of amplitude of the signal for a batch of substrates to determine a property of the overlying or underlying material of the substrate.

84. (once amended) A method according to claim 83 wherein the step (c) comprises determining if the [amplitude change] dynamic variance is within the calculated or stored range.

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86. (once amended) A method according to claim 85 comprising providing the instruction signal to adjust process conditions at the beginning of processing of the substrate.

87. (once amended) A method according to claim 83 comprising evaluating [wherein the amplitude change comprises] a change in the dynamic variance of the amplitude.

88. (once amended) A substrate processing apparatus comprising:

- (a) a chamber capable of processing a substrate, the substrate having overlying and underlying materials;
- (b) a radiation source capable of providing radiation that is at least partially reflected from the substrate during processing;
- (c) a radiation detector adapted to detect the reflected radiation and generate a signal; and
- (d) a computer having a memory capable of operating a computer-readable program embodied on a computer-readable medium, the computer readable program including program code to receive the signal and evaluate [an amplitude change of the reflected radiation] a dynamic variance of amplitude of the signal in relation to a range of [amplitude changes] dynamic variances of amplitude of the signal for a batch of substrates to determine a property of the overlying or underlying material of the substrate.

89. (once amended) An apparatus according to claim 88 wherein the program code is adapted to [evaluates] evaluate the [amplitude change] dynamic variance to determine if the [amplitude change] dynamic variance is within the range.

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90. (once amended) An apparatus according to claim 88 wherein the program code is further adapted to provide an instruction signal to remove the substrate from the chamber, end processing, or adjust process conditions, in response to the evaluation of the [amplitude change] dynamic variance.

102. (once amended) A substrate processing apparatus comprising:  
a chamber capable of processing a substrate, the substrate having overlying and underlying materials;

a radiation source capable of providing radiation that is at least partially reflected from [a] the substrate in the chamber;

a radiation detector adapted to detect the reflected radiation and generate a signal having a dynamic variance of amplitude;

a controller adapted to receive the signal and generate a set of data from the dynamic variance of amplitude relating to a property of the overlying or underlying material of the substrate; and

a factory automation host computer to receive and evaluate the data, and control the processing of the substrate in relation to the data.

104. (once amended) An apparatus according to claim 103 wherein the software program is adapted to [evaluates] evaluate the data to determine statistical process control parameters.

106. (once amended) An apparatus according to claim 105 wherein the factory automation host computer is adapted to provide the instruction signal to adjust process conditions at the beginning or end of processing of the substrate.